

Report to the Chairman, Committee on
Governmental Affairs
United States Senate

May 1986

SERGEANT YORK

Concerns About the
Army's Accelerated
Acquisition Strategy



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May 30, 1986

The Honorable William V. Roth, Jr.
Chairman, Committee on Governmental Affairs
United States Senate

Dear Mr. Chairman:

In your letter of November 5, 1984, you requested information on (1) the Sergeant York's unique accelerated acquisition strategy and its suitability for use in future programs, (2) whether the Sergeant York's original mission and operational requirements had been changed in light of the weapon's performance in testing, (3) the protection against cost growth offered by the warranty provisions of the Army's contract with Ford Aerospace and Communications Corporation, particularly regarding technical performance problems, (4) the weapon's achievements in certain specific areas during testing, and (5) the factors considered in the source selection process that had led to awarding Ford Aerospace the contract to complete development and produce the weapon system.

On August 27, 1985, the Secretary of Defense announced his decision to cancel the Sergeant York program after only 64 of the planned procurement of 614 weapon systems had been delivered. The latest operational tests had shown the Sergeant York to represent only a marginal improvement over other available air defense systems in countering the threat. Therefore, the Secretary believed that completing the program was not worth the investment.

In view of the Secretary's action, we discussed your request with your office to determine which of your concerns would be of continuing interest to you. Based on these discussions, we agreed that we should focus on the first concern, that of the acquisition strategy, but include such information on the warranty provisions and the Sergeant York's testing history as was necessary to assess the strategy's effect on the Sergeant York program.

The Sergeant York program's acquisition strategy contained elements which succeeded in controlling costs, but it would not have achieved the desired early deployment even if the program had continued. Army managers had hoped to accelerate the Sergeant York's deployment by scheduling less testing prior to production than is normally conducted

under conventional acquisition strategies. As a result, critical information about shortcomings in the Sergeant York's ability to perform under realistic battlefield conditions was unavailable to decisionmakers until after the system had entered its fourth year of production. In addition, surveillance over the weapon's early development was limited to a few officials. This, together with the Army's determination to come as close as possible to meeting the schedule, in our opinion, created an atmosphere of unwarranted optimism about the prospects of overcoming some serious technical shortcomings disclosed in the weapon's tests. In responses to our prior reports in which we urged caution in proceeding with Sergeant York's production, the Department of Defense (DOD) maintained that technical risks were not so great as to warrant delays and that cost savings would result by maintaining the schedule.

We believe the Army should continue to try to reduce the time it takes to prepare weapon systems for deployment. However, we believe that if the Army is going to apply the type of strategy used in the Sergeant York program to future programs, certain conditions should be present and certain actions taken to provide greater assurance that the strategy will succeed. We are making some recommendations along these lines to the Secretary of Defense.

Background

The Sergeant York air defense gun system was being developed to fill a void in the Army's air defense in the forward battle area. The system was to engage enemy helicopters and fixed-wing aircraft used in close air support. It was to have a three-member crew, and its armament included twin 40-mm. radar-directed computer-controlled guns. In all, 614 gun systems were to be procured at a cost of \$4.04 billion.

The Sergeant York was to be acquired under an accelerated strategy, the objective being to field the weapon as quickly as possible with substantial cost savings. This accelerated approach featured parallel development by two competing contractors; a "skunk works" approach to contracting, which gave each contractor the flexibility to trade off some requirements in order to lower costs; a short combined development and operational test; and a concurrent follow-on development and initial production phase. The strategy also emphasized minimum government management during system development and restricted access to contractors and contractor information to avoid leaking proprietary or competition-sensitive information and to reduce the likelihood of a protest from the contractor not selected for production.

The Army recognized that the Sergeant York's accelerated strategy carried higher than usual risks. It sought to minimize them and thereby guard against cost growth by providing safeguards, such as requiring the contractors to use mature, proven subsystems in the weapon's design and by including more extensive warranty provisions in the Sergeant York contract than were common in other major weapons contracts. In addition, the negotiation of a fixed-price development contract, which included three fixed-price production options, was intended to provide further protection against cost growth during production when only one contractor would be producing the weapon.

The Sergeant York's acquisition strategy was to have three phases: (1) engineering development, which included a 29-month competition between two contractors selected from an original group of five, (2) follow-on development (referred to as maturity) and initial production by the winning contractor, and (3) follow-on production. The acquisition strategy was designed to field a system in about 6-1/2 years, from program initiation in February 1977 to achieving initial operational capability in October 1983.

In May 1981, the Army awarded Ford Aerospace a contract to complete the weapon's development, which also included three fixed-price production options to be exercised at 1-year intervals for 50, 96, and 130 fire units, respectively, beginning in May 1982. The third year's procurement quantity was later reduced to 117. Exercise of the options was tied to a designated calendar date rather than to a demonstration of technical performance. The Army exercised the first two production options in fiscal years 1982 and 1983 for a total of 146 units. Target prices for these two options were \$350.1 million and \$438.5 million, respectively.

Funds were appropriated for the third production option in fiscal year 1984. Exercise of this option was delayed pending further testing requested by the Secretary of Defense. Development tests of production fire units were completed in May 1985. Operational tests of production units were completed in June 1985. Evaluations of the results of both tests were furnished to the Secretary in late August. His decision to terminate the program followed.

Assessment of the Acquisition Strategy

We assessed how successful the Sergeant York's acquisition strategy was in containing cost growth, deploying the weapon quickly and on schedule, and producing a weapon system that performed satisfactorily. Up to the point of termination, cost control appeared good. However, the

desired acceleration in fielding the Sergeant York had not been achieved and the gun system's performance was deficient in several key areas.

Cost Control Maintained

Up to the program's termination, costs to the government had remained relatively stable, a significant achievement considering the pattern of cost growth exhibited by many weapons during their development and early production. The use of mature components contributed to this favorable cost experience. However, significant technical difficulties were encountered during attempts to integrate the components into a workable weapon system. This suggests that the use of the fixed-price development contract and the three annual fixed-price production contract options were more effective in controlling costs. The Sergeant York contract's warranty provisions also were designed to contribute to further cost control. The fixed-price options did have a drawback in that they put pressure on decisionmakers to proceed with production on schedule despite the weapon's technical difficulties and unknowns to take advantage of the favorable prices they offered.

A major challenge to the Army's ability to maintain the program's cost control would have come with the negotiation of the first full production contract, which was to be awarded in January 1986. That contract was to be negotiated with the benefit of actual production experience but without the price protection the fixed price options had provided. Cancellation of the program's third phase leaves unanswered the question of whether cost control would have continued.

Accelerated Deployment Not Achieved

The desired acceleration in fielding the Sergeant York was not realized. At termination, the Army was projecting that the Sergeant York would not achieve initial operational capability before March 1987, 10 years after program initiation, compared with the 6-1/2 years originally planned. However, this interval is still somewhat less than was experienced by seven other major Army weapon systems we selected for comparison. These systems, some of the largest Army acquisitions since the mid-1970's, were acquired under more conventional strategies and averaged 12 years from program initiation to initial operational capability. Their acquisition periods ranged from 8 years for the M1 tank to 16 years for the Patriot missile.

One reason for the delay in fielding the Sergeant York was that the prototype gun systems the contractors delivered for testing were less technically mature than anticipated. This caused testing delays and the need

for more testing than had been planned. The integration of the weapon's major subsystems and their application to a weapon for which they had not been originally designed apparently represented a greater technical undertaking than originally anticipated. A second reason was that in some instances, the minimum government involvement and limited testing features of the acquisition strategy prevented essential program information from reaching decisionmakers to support budget requests. Limited program information regarding system performance and program progress contributed to the Army's planned fiscal year 1981 purchase of Sergeant York being deleted from that year's defense budget and resulted in a major program delay.

Both limited information regarding performance in operational testing and problems revealed in testing were key factors in the Secretary of Defense's decision in September 1984 to delete production funds from the fiscal year 1985 budget and defer further production until the results of testing concluded in 1985 were available for his review. The wisdom of this decision was borne out by the test results, which showed the Sergeant York's ineffectiveness in overcoming the threat.

Serious Shortcomings in System Performance

The Sergeant York's most definitive tests were the initial production and follow-on operational tests completed in mid-1985. The operational test was the first attempt to assess the Sergeant York's performance in a realistic battlefield environment.

The 6-month initial production tests measured the weapon's performance against the contract specifications. The Sergeant York met or exceeded 141 of 163 specifications that were tested, but of the 22 specifications not met, 7 were considered by Army evaluators to be particularly significant. Among the seven were specifications which concerned the reliability of the power and actuation subsystem, the gun's target detection capabilities, and its survivability against certain countermeasures. Concerning the operational tests, the Army's assessment was that the Sergeant York had performed significantly better than the weapon it was to replace, although it was acknowledged that there were still some shortcomings to be corrected. However, according to the evaluation of the Director, Operational Test and Evaluation, in the Office of the Secretary of Defense—the one accepted by the Secretary of Defense—the Sergeant York represented only a marginal improvement over other available air defense weapons, was ineffective in performing the air defense mission, and was unsuitable for combat operations because it had a low operational availability.

Protection Offered by Warranty Provisions

The contract to acquire the Sergeant York provided protection against cost increases emanating from defects in the design, component integration, materials, or workmanship which could preclude meeting the specification requirements. This protection went beyond that generally obtained for other weapon systems, where the contractor's liability does not cover design defects. The warranty provisions made the contractor responsible for correcting the defects without increases to the contract's target cost, target ceiling, or ceiling price and without extensions of delivery time. Under the warranty, the performance of the Sergeant York was to be measured against the detailed requirements in the contract's development specification. These requirements were to be met under the controlled conditions of a development test. The initial production test, a development test completed in May 1985, was to be the basis for determining how the Sergeant York measured up to these requirements. The contractor's warranty responsibilities did not extend to performance of the Sergeant York in operational testing against operational requirements. These requirements, such as mission performance and survivability, were to be demonstrated under less controlled test conditions, which represented a more realistic battlefield environment. Such operational testing was completed in June 1985.

Conclusions and Recommendations

The Sergeant York's acquisition strategy contained some positive elements but, on the whole, was detrimental to the program. Costs were successfully controlled up to the time the contract was terminated, and the warranty provisions in the contract offered the Army protection against cost increases if modifications were needed to bring the system up to specifications.

On the other hand, the desired acceleration in fielding the Sergeant York was not achieved. This was due both to weaknesses in the acquisition strategy and to the technical performance difficulties of the weapon itself; however, it is not possible to sort out the relative contribution of each. The technical difficulties experienced by the weapon system were not a fault of the acquisition strategy. Technical difficulties can be encountered in developing any complex system, irrespective of the acquisition strategy used. However, the Sergeant York's tight schedule and the limited operational testing, both of which were critical elements of the strategy, left few opportunities to resolve these difficulties before major production commitments were made. Also, while they were beneficial from a cost control standpoint, the fixed-price production options put more pressure on decisionmakers to proceed on schedule even

though they recognized the risks the weapon's technical difficulties posed.

Another disadvantage of the strategy was that because it limited the opportunities for testing, it did not give decisionmakers as much information at given points in time as they normally get under more conventional strategies. In this sense, the strategy did not provide essential information regarding the Sergeant York's performance when needed to support budget decisions. The need for such information led to funding delays. Concern over the lack of operational testing became a key stumbling block to the program's future but not until after the system was well into production. The deferral of some tests and the mixed results of others made the strategy to limit operational testing no longer acceptable.

Confining surveillance over the Sergeant York's development early in the program to just a few individuals within the Army provided little opportunity to hold the program up to wider and more critical scrutiny in the Army's higher echelons, the Office of the Secretary of Defense, and the Congress. This, coupled with confidence in the use of proven components, fueled optimism about the Sergeant York's eventual performance and enabled the initial production decision to be made on the basis of limited testing. Subsequent test results showed these views to be overly optimistic.

The program also provides some insight into the limitations of a contractor's warranty. The Sergeant York warranty, while it provided protection against the weapon system not meeting the contract's performance specifications, offered no guarantee that the weapon would perform satisfactorily in an operational environment, where factors such as weather, terrain, and countermeasures aggravate the difficulties of coping with the threat. However, the benefits derived from having a warranty which requires that a system perform to specifications in a nonoperational environment probably will, to a certain extent, carry over to its performance in an operational environment.

The Army should continue trying to reduce the time it takes to develop and field new weapons as long as performance is not adversely affected. However, we believe there are lessons to be learned from the events that followed the application of the accelerated acquisition strategy to the Sergeant York program and are recommending that, when the Army considers such strategies for future programs, the Secretary of Defense require the Army to:

- Make an initial detailed assessment of the technical risks involved in individual subsystems, as well as in the integration of those subsystems into one system, with an explicit focus on whether the technology being attempted is compatible with an accelerated acquisition strategy. Built into the strategy should be provisions for adjusting schedules and other program facets if technical difficulties occur.
- Assess the weapon's technological progress periodically to see if it is still compatible with the planned acceleration. If technical progress is no longer keeping pace with the acceleration, the strategy should be adjusted to bring it in line with the technology.
- Ensure that the strategy provides for testing and evaluation sufficient to identify for decisionmakers any major shortcomings in a weapon's operational suitability and effectiveness which have to be resolved before initial production is approved.

Agency Comments and Our Evaluation

DOD generally concurred in our findings and recommendations. It expressed the view that there was no need for further guidance on assessing risks and on assessing the continuing compatibility of a weapon system with its acquisition strategy. The Department noted that such guidance was in effect when the Sergeant York's acquisition strategy was devised. In the case of the Sergeant York, however, DOD said a conscious decision had been made to use a unique acquisition strategy with attendant recognized risks. It recognized that specific lessons had been learned, particularly with respect to the "hands off" aspects of the strategy. It believed procedures in its departmental directives and lessons learned from the Sergeant York's acquisition should help preclude a recurrence of the types of difficulties that were experienced with the Sergeant York.

Although additional guidance may not be necessary, we believe attention must be given to enforcing existing guidance in accelerated acquisition strategies to help ensure (1) early recognition of indications that technical risks may be present which are greater than originally anticipated and (2) adjustments to strategies, as necessary, to bring them into line with the technical risks before programs have progressed too far.

While agreeing with the need to furnish decisionmakers with evaluations of weapon system performance based on adequate, realistic operational testing, DOD noted that emphasis on such testing had been incorporated in a revised DOD Directive 5000.3, published in March 1986. According to DOD, this directive incorporates the requirements of Public Law 98-94, dated September 24, 1983, which established the Office of

Operational Test and Evaluation under the Secretary of Defense. That law stipulates that a full production decision shall not be made until the director of that office has submitted a report to the Secretary of Defense and to the Congress stating that adequate tests of the system have been conducted and the results have confirmed that it is effective and suitable for combat. The Department noted that the decision to produce the Sergeant York had been made before the law was passed

The proper implementation of Public Law 98-94 should ensure an evaluation of operational test results before a full production decision is made. There are cases when similar caution should be observed before a system is allowed to begin initial low-rate production. Our concern stems from the fact that the Sergeant York, in accordance with its accelerated acquisition strategy, began initial production without a confirmation that the weapon could fulfill its basic mission in an operational environment—protecting friendly forces against enemy helicopters. In accelerated programs, such as the Sergeant York, there is a danger that operational testing requirements will be relaxed without provisions being made in the acquisition strategy that would enable identifying for decisionmakers any major shortcomings in operational effectiveness prior to initiating production.

Our draft report included a recommendation on this matter, stated in general terms, which called for evaluations of performance based on adequate and realistic operational testing to be made before the production decision. Considering that operational testing requirements of Public Law 98-94 have been incorporated into revised DOD Directive 5000.3, we have modified our recommendation to focus on the need for an accelerated acquisition strategy to provide for an identification of major shortcomings in the weapon's operational effectiveness and suitability that must be resolved before it is approved for initial production.

DOD also suggested other changes in the report which we have incorporated, as appropriate.

The details of our findings appear in appendix I. DOD's comments are in appendix II.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 3 days from the date of the report. At that time we will send copies to interested parties and make copies available to others upon request.

Sincerely yours,

A handwritten signature in black ink, reading "Frank C. Conahan". The signature is written in a cursive style with a large, stylized "F" and "C".

Frank C. Conahan
Director

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Abbreviations

DOD	Department of Defense
GAO	General Accounting Office
MASAD	Mission Analysis and Systems Acquisition Division
PSAD	Procurement and Systems Acquisition Division

Assessment of the Accelerated Strategy Used to Acquire the Sergeant York

Introduction

The Army planned to acquire the Sergeant York under an accelerated strategy. As originally conceived, this approach contained features such as concurrent development and production and limited testing, coupled with the use of components that had already been developed for other weapon systems. Together, these features were expected to enable the Army to field the gun several years sooner than it takes to field weapons acquired under more conventional programs and to do so at substantial savings.

The original acquisition strategy, dating back to February 1977, was to be accomplished in three phases containing several interrelated elements. These consisted of engineering development, maturity and initial production, and follow-on production. The first phase was to include a 29-month competitive development effort between two contractors, selected from an original group of five, culminating in a "shootoff" to be followed by source selection. In the second phase, the selected gun system would complete development during a maturity phase, which was to involve correcting problems discovered in the competitive test and conducting additional tests to ascertain whether weapon system performance had improved. Initial production was to begin in phase II as well. Phase III encompassed producing the remaining gun systems and achieving initial operational capability.

The Army planned to buy 614 units of the Sergeant York. However, on August 27, 1985, the Secretary of Defense terminated the program after only 64 units had been delivered. The Secretary cited the weapon's unsatisfactory performance in recent tests which Department of Defense (DOD) test evaluators said showed little improvement over existing air defense systems. The Secretary felt that completing the program was not worth the investment.

Features of the Sergeant York Acquisition Strategy

The Sergeant York's acquisition strategy was unique in that it combined several features in an attempt to accelerate fielding. These features included parallel, competitive development; a "skunk works" approach to contracting in which contractors were given free rein to design the system in a way they thought most appropriate for meeting the Army's requirements; a "hands-off" approach in which the government's management role was minimal during the weapon's development; a short, combined development and operational test prior to production; and a phase which combined the system's follow-on development, referred to as the maturity phase, and initial production. These factors were

intended to significantly shorten the development phases preceding initial production. The accelerated program was recognized as having technical and cost risks. Therefore, the program included several safeguards that the Army believed would minimize these risks. Prominent among these were the use of available, proven components and the negotiation of (1) a fixed-price development contract with fixed-price production options and (2) warranty provisions intended to protect the government against cost increases resulting from corrections of design and other deficiencies.

Competitive Prototyping

The first phase of the acquisition strategy was to be a development competition between two contractors. This was to culminate in each contractor delivering complete prototypes to the Army for testing. The advantages of this approach were having more than one candidate for the mission, having actual hardware on which to base a comparison, and stimulating individual contractor creativity in devising a weapon to fulfill the mission.

Some of the advantages of the competition may have been lost when the Army decided it would select a contractor for the phase II full-scale development and initial production contract after the competitive development and operational tests were completed and evaluated. Both the Ford Aerospace prototype, the one selected, and the competing prototype submitted by the General Dynamics Corporation displayed numerous shortcomings during the tests. It was evident at the time that both prototypes still required considerable development. This is not to question the Army's preference for the Ford Aerospace prototype at that stage of development but merely to point out that in view of the immaturity of the two prototypes, it may have been prudent to wait for the further development of both prototypes before making a selection.

We had recommended such a course in a report to the Congress in January 1980.¹ In that report, we pointed out that important durability and maintainability tests would not be conducted until after the source selection. DOD responded that (1) durability tests were not expected to affect the competition since Army engineering judgment indicated that the results were likely to be similar for both prototypes, (2) the cost and time to run tests which were not expected to affect the competition were

¹Inherent Risk in the Army's Acquisition Strategy Demands Particular Caution in Evaluating the Division Air Defense Gun System's Production Readiness (GAO/C-PSAD-80-9, Jan 31, 1980)

needed elsewhere, and (3) the competition was being driven by other tests which the Army would conduct.

**Minimum Government
Involvement and Contractor
Flexibility**

The Sergeant York acquisition strategy featured a "hands-off, skunk works" approach to the weapon's development. This emphasized minimum government management during development and limited the Army's activities to holding quarterly 2-day design review meetings at each contractor's location and to reviewing contractor-generated reports. The strategy embodied having thinly staffed government and contractor project offices shielded from interference by other concerned government officials, reducing the reporting requirements, limiting access to contractors and contractor information considered to be competition sensitive, and giving the contractors the freedom and responsibility to design and develop a weapon that would satisfy Army requirements.

Critical to this flexibility was the authority each contractor was given to trade off some of the requirements for others on the basis of performance versus costs. The Army established 12 firm requirements that each competing contractor's weapon system had to meet. Beyond these, the Army identified 43 system requirements in priority order which each contractor could trade off to help lower the program's cost. For example, Ford Aerospace elected not to equip its weapon with night vision capability, 1 of the 43 tradable items, in an effort to keep unit production costs down.

**Concurrency and Limited
Testing**

To enhance the prospects of accelerating the Sergeant York's fielding, the Army chose to (1) perform developmental activities concurrently with production and (2) conduct less testing before the production decision than is usually conducted under a more conventional acquisition strategy.

Under the strategy, the competitive "shootoff" test was the only government test scheduled before the Army was to select a source and award the phase II contract. Phase II itself was to involve initiating production before completing the development of the weapon system. Another government test, referred to as a "check test," was planned at the conclusion of the maturity phase to ascertain whether the winning contractor had resolved problems revealed in its system during the competitive testing. The next government test was to involve initial production units and was not slated to begin until the end of phase II.

As a consequence of the desire to accelerate the schedule and to maintain minimum government involvement, substantial portions of development and operational testing were not planned to be held until after production was to begin. Development tests deferred until after production began included operation in a cold climate, durability of the system in stressful battlefield conditions, system transportability, and electromagnetic compatibility and interference.

Although certain government operational tests were to be held before the production decision, they were constrained by the limited realism of the test environment, which to some extent was unavoidable because of safety considerations; the deferral of some activities usually begun during development, such as integrated logistic support; and the few fire units made available for testing.² Operational issues which were not planned to be fully evaluated before the production decision were operation and maintenance by Army personnel; proposed doctrine, tactics, and training; and system effectiveness and survivability as part of a larger force in combat.

Development of integrated logistic support requirements and resources was deferred until after the winning contractor was selected so that these costs would not be incurred to support more than one system. Integrated logistic support includes the concept for maintaining the weapon in the field, procuring test and support equipment, training personnel, and preparing operating and maintenance manuals. Development of these elements is important to operational testing, for a key element of such testing is the Army's ability to train soldiers to operate and maintain the weapon under battlefield conditions.

Safeguards Against Risk

The Sergeant York's accelerated acquisition strategy involved risks, particularly in view of the planned concurrency and limited testing. To make these risks acceptable, several safeguards were built into the program. These included using proven components, obtaining more extensive warranty coverage than generally found in other major weapon contracts, and negotiating fixed-price development and production contracts.

²Operational testing is intended to assess system operational effectiveness and reliability, when operated and maintained by military personnel, in a realistic combat environment and against a simulated enemy threat. Operational effectiveness is the capability of the weapon to accomplish its mission. Operational suitability is the weapon's capability to be satisfactorily placed in field use considering, among other things, the capability to operate, maintain, and support the weapon.

Use of Proven Components

A ground rule established for the phase I competition was that each contractor was to use already proven subsystems in weapon designs. It was felt that use of proven subsystems rather than an all-new design would reduce potential design problems and allow for an accelerated development schedule. The major development task was anticipated to be integration of the subsystems. Each contractor was to use the M48A5 tank chassis as the vehicle for its weapon system, and each chose a mature radar and gun system to include in its design.

Warranty Provisions

When Ford Aerospace emerged as the winner of the phase I competition, the contractor accepted responsibility for the weapon system's meeting the technical specifications in the maturity phase. These specifications were derived from the Army's stated air defense gun requirements. In essence, the warranty required Ford Aerospace to correct characteristics of the weapon system which did not meet the specifications at no increase in price to the Army. The contract also required Ford Aerospace to correct problems attributable to defective workmanship or material. In the Army's view, this warranty represented a safeguard against cost increases that could arise from a need to correct performance deficiencies.

According to the Army, prior to the warranty legislation included as section 794 of the fiscal year 1984 Department of Defense Appropriation Act, the standard warranty clause in procurement regulations traditionally covered only workmanship defects. By obtaining a warranty against design and integration deficiencies, the Army obtained protection against claims arising from design defects which are typically the more significant problem for the government.

Section 794 required the government, in weapon system production contracts, to obtain written guarantees, or warranties, from the prime contractor. The warranties were to (1) cover conformance of the design and manufacture of the system and its components to the government's specifically delineated performance requirements and (2) ensure that the system and its components were free of defects in materials and workmanship which would cause the system to fail to meet the government's performance requirements.

The contract for initial production of the Sergeant York was awarded in May 1981, before enactment of section 794. Nevertheless, the contract's correction of deficiencies and system responsibility provisions parallel provisions found in section 794 in the areas of

- design and manufacturing deficiencies,
 - deficiencies in materials and workmanship, and
 - costs to repair or replace parts to achieve required performance.
-

Fixed-Price Contracts

Fixed-price development contracts were awarded to the two contractors that participated in the competition. In addition to offering cost control, this type of contract was viewed as complementing the "hands-off" and tradable requirements features by eliciting the contractors' best efforts for a given price. The three production options included in phase II were also fixed priced (with incentives). Each contractor made proposals on these production options during the competition. The intent was to provide protection against cost growth during production when only one contractor would be producing the weapon. The production prices thus had the benefit of being established through competition. The Army also held open the possibility of reopening competition for phase III production as additional cost protection.

Program Results

In our 1983 report on the Sergeant York,³ we noted that in the final analysis, the acquisition strategy's success would be measured by its contribution to the Army's ability to (1) contain cost growth, (2) deploy the weapon on schedule, and (3) produce an effective system. Up to the time the program was canceled, cost control appeared good. However, it was evident that the desired acceleration in fielding the Sergeant York would not be achieved and that technical performance as measured by test results was inadequate to meet the threat.

The contractual aspects of the strategy did hold down program costs. However, this advantage was outweighed by other elements of the strategy, which contributed to the program's cancellation. These were (1) the "hands off" approach during the development phase, which limited program reviews of the contractor's progress to only a few individuals within the Army and inhibited wider dissemination of information about the program, and (2) the reduced testing that the strategy dictated.

Cost Growth Was Contained

Costs to the government for the Sergeant York remained relatively stable. The fact that program costs did not increase significantly was

³The Army Should Confirm Sergeant York Air Defense Gun's Reliability and Maintainability Before Exercising Next Production Option (GAO/MASAD-83-8, Jan 27, 1983)

commendable given the cost growth other Army weapons have experienced, particularly as they make the transition from development into production.

The control of costs can be attributed to three features of the Sergeant York's acquisition strategy: (1) the use of fixed-price production options covering nearly half the planned quantities, (2) the use of proven components to reduce the technical development costs, and (3) the use of integrated prototypes during competition. Considering that despite using proven components and integrated prototypes, the program still experienced significant difficulties with integrating components and encountered serious performance problems, the use of fixed-price contracts emerges as the most effective cost control feature of the Sergeant York's acquisition strategy. Another feature of the strategy which the Army expected to contribute to cost control was the broadened protection offered by the contract's warranty provisions, which covered not only deficiencies in materials and workmanship but design deficiencies as well. The contractor had to correct design deficiencies at its expense for the system to meet specifications.

Up to the time the program was canceled, it was evident that the acquisition strategy was helpful in controlling costs. However, the program never reached the point where the Army would face the challenge of negotiating the next production contract based on actual production experience. In the past, several weapon systems have experienced significant cost growth at this point as the actual costs on the previous production contracts were higher than expected and became the basis for negotiating higher prices on new contracts.

While the fixed price options must be credited with holding down the cost of the first 146 gun systems under contract, the options did have a drawback in that officials gave too much weight to them when considering decisions whether to proceed with production on schedule even when serious technical difficulties were present and critical performance capabilities were not demonstrated. In responses to our prior reports in which we urged caution in proceeding with Sergeant York's production, the Department of Defense maintained that technical risks were not so great as to warrant delays and that cost savings would result by maintaining the schedule. Army officials maintained that deferring production would cause a lost opportunity to take advantage of favorable procurement options.

**Accelerated Fielding Was
Not Achieved**

The acquisition strategy did not achieve early deployment of the Sergeant York, one of its major objectives. The gains in time the Army anticipated from combining development and initial production were never realized. Starting with the immaturity of the prototypes delivered for the 1980 competitive tests, the program began to slip. Tests were delayed, others had to be added, and the Office of the Secretary of Defense became involved in reviewing the program and in evaluating the Sergeant York's performance in the tests.

Shown in table I.1 is the latest schedule that the Army projected for the Sergeant York compared with the original schedule. Dates are not shown in the original schedule for tests which were added later.

Appendix I
Assessment of the Accelerated Strategy Used
to Acquire the Sergeant York

Table I.1 Actual or Projected Schedule of Events Compared With Original Schedule

	Actual or projected schedule	Original schedule
Phase I (Engineering Development)		
Award competitive engineering development contracts	Jan 1978	Jan 1978
Competitive development and operational test		
Start	June 1980	June 1980
Complete	Nov 1980	Sept 1980
Phase II (Maturity and Initial Production)		
Award phase II contract	May 1981	Oct 1980
Check test		
Start	Nov 1981	Oct 1980
Complete	Jan 1982	Dec 1980
Production decision	May 1982	Oct 1980
Reliability, availability, maintainability, durability test		
Start	Feb 1982	
Complete	Apr 1982	
Contractor engineering test		
Start	Apr 1982	
Complete	Dec 1982	
Engineering prototype unit test		
Start	May 1983	
Complete	Aug 1983	
Deliver first production unit	Mar 1984	June 1982
Design verification test		
Start	Mar 1984	
Complete	Dec 1984	
Limited test		
Start	July 1984	
Complete	Aug 1984	
Initial production test		
Start	Dec 1984	July 1982
Complete	May 1985	Jan 1983
Follow-on-evaluation I		
Start	Apr 1985	
Complete	June 1985	
Phase III (Follow-on Production)		
Award phase III contract	Jan 1986	Oct 1982
Initial operational capability	Mar 1987	Oct 1983
Follow-on evaluation II		
Start	Feb 1987	
Complete	Apr 1987	
Production complete	June 1990	Aug 1987

According to the actual/projected schedule, initial operational capability of the Sergeant York, had the program continued, would have been achieved about 3-1/2 years later than called for under the original schedule. Whereas initial operational capability was to be achieved in about 6-1/2 years after program initiation in February 1977, the Army was projecting it would take about 10 years to achieve. The major causes of this delay appear to be (1) deletion of fiscal year 1981 production due to funding cuts which delayed the first year's production by about 1-1/2 years, (2) production start-up problems, which delayed deliveries, and (3) deferral of the third production option decision to conduct additional operational testing, which led to stretching out deliveries of units already under contract to avoid a production line shutdown.

To compare the time it took to begin the planned fielding of the Sergeant York with the time it took to field weapon systems acquired under more conventional strategies, we selected seven systems representing some of the largest Army weapon programs fielded since the mid-1970's. These averaged nearly 12 years from program initiation to initial operational capability. Thus, the Sergeant York's latest schedule still represented quicker fielding than the average time for the seven systems using more conventional strategies. The systems are shown in table I.2.

**Table I.2 Acquisition Time Frames for
Other Army Weapons**

Weapon System	Years to Field
AH-64 helicopter	13 5
Copperhead projectile	10 8
Hellfire missile	13 3
M1 tank	8 2
Bradley Fighting Vehicle	11 7
Patriot missile	15 7
Pershing II missile	9 9

On the other hand, the Sergeant York's schedule was not as rapid as two major weapons already being fielded under accelerated strategies—the Multiple Launch Rocket System and the Black Hawk helicopter—which achieved initial operational capability 6.2 years and 8.4 years, respectively, after program initiation. It is also interesting to note that while the Sergeant York saved time by essentially bypassing the advanced

development phase, it was destined to spend more time between the initiation of engineering development and the latest projected initial operational capability (9.3 years) than the seven weapons acquired under conventional strategies (an average of 7.7 years).

Comparison With the Multiple Launch Rocket System Acquisition

The Army employed an acquisition strategy similar to the Sergeant York's to acquire the Multiple Launch Rocket System. It consisted of a competitive development phase of 29 months (later extended to 32 months), which concluded with a combined development and operational test. On this basis, a contract was awarded to a sole source for a maturity phase and low-rate production with options for additional low-rate production. Initial operational capability of the system was achieved in March 1983, just over 6 years after program initiation and 4 months later than planned.

Based on our limited review of the Multiple Launch Rocket System, several factors appear to explain why, under a similar strategy, the system was fielded essentially within 6 years.

First, the Multiple Launch Rocket System is made up of previously applied technology, as was the Sergeant York. However, Army documents show that the weapon design is relatively uncomplicated and no gaps existed in its technology. Being akin to an artillery piece, it does not have to acquire individual targets, such as tanks or aircraft, nor does it engage moving targets. Therefore, it does not have a radar, has less sophisticated fire control, and does not have to fight at the front of the battle alongside tanks. These factors make for a less sophisticated weapon than the Sergeant York was to be.

Second, time was set aside in the Multiple Launch Rocket System acquisition strategy for final operational testing of production units prior to the full-scale production decision. The Sergeant York strategy, as originally conceived, did not provide for such testing until after full-scale production had been approved.

Third, although the rocket system exhibited reliability and accuracy problems even when full-scale production began, the program was not delayed to effect solutions, as was done with the Sergeant York. We did not determine why technical problems had been handled differently in the Multiple Launch Rocket System, but two factors may have been influential. First, reliability was only 1 percent below minimum acceptable values. Second, the fact that a second operational test had been

conducted on the system may have given decisionmakers more confidence in the weapon's performance.

Strategy Underestimated Need for
Testing

Sergeant York test units were less technically mature than anticipated during the program, giving rise to testing delays and the need for additional testing. Apparently, the integration of the weapon's major subsystems, as well as their application to a weapon for which they had not been originally designed, represented a greater technical undertaking than anticipated. Evaluations of the Sergeant York's test performance by the Office of the Secretary of Defense were less optimistic than the Army's and led to changes in the program's course. Under pressure to demonstrate the weapon's capability before it could obtain approval to proceed with the third year's procurement, the Army added some tests and moved others forward.

Under the acquisition strategy, following a 30-day demonstration of each contractor's prototype, the two competing contractors were to deliver prototypes to the Army for the competitive testing. After source selection in October 1980, the winning contractor was to conduct a maturity effort on its weapon to correct problems revealed in the competitive test. The Army then planned to run a check test in May and June 1981 to verify that the problems had been corrected. Prototypes from both contractors were unexpectedly immature, which caused the 30-day demonstration to be canceled and delayed the start of the competitive testing. The test was completed about 2 months late because the Army needed more time to conduct the test and to compensate for delays during testing. Under the acquisition strategy, this was the first opportunity the Army had to test the prototypes, and it appeared to be surprised at the weapons' immaturity.

The Ford Aerospace prototypes, at the time Ford won the competition, had numerous deficiencies which needed to be corrected before the scheduled check test. The check test did not demonstrate that all deficiencies had been overcome. However, Army and Office of the Secretary of Defense officials supported exercising the first production option on the basis that most performance requirements had been met and sufficient development progress had been made.

By this time, the durability and maintainability test had evolved into a 7-month test that would also cover reliability and availability. Though this test was originally scheduled to begin in February 1982, the Army delayed the start until May 1982 to give the contractor more time to

upgrade its prototype for the test. Nonetheless, after three attempts to demonstrate the prototype's readiness for production, the Army test and evaluation agencies concluded the prototype was unsuitable for testing and discontinued the test. DOD officials stated at the time that the test had been terminated because certain prototype subsystems were close to wearing out due to constant testing and because the prototype lacked a number of features which would appear in the production model. However, reliability problems continued throughout the program's life when new prototypes and initial production units were tested.

Two additional tests were added to the program before the scheduled exercise of the third production option. The engineering prototype unit test ran from May through August 1983 to assess the reliability of the ammunition feed system, which had performed poorly during the check test. In addition, a design verification test was conducted during 1984 to complete production unit acceptance test procedures and to assess reliability and performance in support of exercising the third production option.

A series of events occurred in early 1984 which combined to stretch the program out further. Ford Aerospace delivered its first production unit in March 1984, about 5 months later than called for in the contract. The contractor had encountered problems in making the transition from prototypes to production units, including test failures, design changes, rework, and assembly difficulties.

The Under Secretary of Defense for Research and Engineering then directed the Army not to exercise the third production option until solid test results were available. This decision was based on the delay of several events which were to have occurred before the option was exercised, including delivery of 33 production units, initial production testing, maturity testing, and qualification testing. All these events had either not started or their completion was behind schedule. The Under Secretary noted the limited testing conducted since the initial production decision had been severely constrained by differences in the configuration of the articles tested, limited duration of the tests, and unrealistic test conditions. In addition, the tests conducted disclosed several technical problems. Consequently, the Under Secretary directed the Army to conduct a realistic period of operational testing before exercising the third production option.

The Army conducted this testing in July 1984, referred to as the "limited test." Test results were inconclusive because of the limited realism of the test conditions and the lack of statistically significant numbers. Then the Secretary of Defense decided to defer exercising option III and to delay initiating phase III of the program until after additional operational tests, which were completed in June 1985. This testing was to be the first of two follow-on evaluations. The second series would have been held in 1987 had the program continued.

**Insufficient Information for
Decisionmakers**

Two features of the Sergeant York's acquisition strategy—the hands-off management by the Army during phase I and limited testing—at times made it difficult to justify funding requests for the program and, as a result, contributed to program delays.

In May 1978, the Sergeant York project manager cited several potential risks inherent in the program, including a concern that information on the progress of the development program might be inadequate to justify funding needs to the Office of the Secretary of Defense, the Office of Management and Budget, and the Congress. The minimum government involvement and the limited testing, particularly during the competition, precluded in-depth knowledge and release of technical performance data on the system under development. These constraints inhibited essential information on system performance and program progress from reaching those who were to make funding and programming decisions. This lack of data contributed to significant reductions in the Army's 1981 planned budget and, in turn, to a major program restructuring. The Sergeant York's funding was cut back to the extent of deleting the fiscal year 1981 buy, the first year's procurement. The restructured program delayed the production decision by 18 months and added 17 months to the initial operational capability date.

Deleting the fiscal year 1985 buy and deferring exercising the third production option were due to the Sergeant York's performance in testing and to the uncertainty about the system stemming from the lack of sufficient operational testing on production units. Defense officials felt that more operational testing was needed than had been planned under the acquisition strategy. Thus, although the acquisition strategy called for little operational testing to be done before initial production such testing proved to be necessary to continuing the program.

**Performance in Testing Was
Unsatisfactory**

Although the Sergeant York had undergone numerous tests since it began development, some important tests had been delayed and the limited operational test added in the summer of 1984 at the direction of the Office of the Secretary of Defense proved to be inconclusive.

The most definitive tests of Sergeant York were those completed in mid-1985. The initial production test, conducted from December 1984 to May 1985 at three test sites, measured the Sergeant York's performance against contract specifications. The operational test, conducted from April to June 1985 at two test sites, determined its capability in a simulated combat environment.

Important Specifications Not Met

The Army Materiel Systems Analysis Activity, in evaluating the initial production tests, found that the Sergeant York either met or exceeded 141 of the 163 contract specifications tested. Of the 22 that were not met, 7 were considered by the agency to be particularly significant. These concerned the reliability of the gun's power and actuation subsystem, its survivability against certain countermeasures, a safety hazard involving the turret's rotation, a problem with the proximity fuze, and the gun's performance against certain threats.

The power and actuation mission reliability specification called for a mean time between failures of 260 hours. The Sergeant York achieved only 36 hours between failures during the test. The Army agency estimated that the entire gun system mission reliability for the test was 21 hours of operation between failures as compared with the specified 37 hours.

Two shortfalls involved the inability of the Sergeant York to meet specifications for correctly identifying certain incoming objects. Details of this performance deficiency are classified. The turret problem concerned the lack of an audible cue to warn the driver of the turret's rotation—a safety hazard when the driver's head was exposed. Other specification shortfalls concerned problems with the performance of the acquisition and tracking radar.

**Army's Assessments of Operational
Test Results Were More Favorable
Than the Secretary of Defense's**

Based on their respective assessments of the operational test results, the Office of the Secretary of Defense and the Army reached different conclusions. The former concluded that the Sergeant York had been ineffective in performing the air defense mission and represented only a marginal improvement over the Vulcan gun. The Army concluded that

the Sergeant York was significantly better than the Vulcan in protecting friendly forces but was ineffective against hovering helicopters.

In planning the operational test, the Army's Training and Doctrine Command developed criteria for measuring the Sergeant York's effectiveness in performing its mission. The determining factor was to be the friendly force's survival while Sergeant York was participating in its defense compared with the survival when the current Vulcan air defense gun was a participant. The Sergeant York was to be judged effective if friendly losses to air attack were 27 to 36 percent lower than losses sustained while the Vulcan was protecting the force.

The test was divided into a series of trials, each lasting 30 minutes. There were a total of 51 valid trials. Army test evaluators were concerned that the small number of trials might not be statistically significant. In addition, evaluators of the Army's Combat Developments Experimentation Center, which made the first of three Army evaluations, questioned the validity of the criteria because of the large number of variable conditions both within and among the trials. The center suggested that an analysis of the results based on the number of opportunities the two guns had to engage aircraft during the trials would provide a statistically significant and more homogeneous sample than an analysis based on the trials. According to evaluators from the center, there were over 1,200 such opportunities when the Sergeant York was operating. The center analyzed the data using both trials and engagement opportunities but gave more weight to the latter. Its evaluators concluded that the Sergeant York had been ineffective in performing its mission.

The center's report was provided to the Army Operational Test and Evaluation Agency for consideration in its independent assessment of the operational test. The agency's evaluators made their assessment in accordance with the criteria developed by the Training and Doctrine Command to evaluate the Sergeant York's performance. However, the agency eliminated some of the trials from its analysis because the aircraft in those particular trials were judged not to pose a threat to friendly forces. As a result, the agency's analysis was based on a smaller sample size than the one the Combat Developments Experimentation Center questioned. The Operational Test and Evaluation Agency concluded that the Sergeant York met the mission performance criteria although it recognized the limitations of the criteria.

The Operational Test and Evaluation Agency did find that the Sergeant York did not meet prescribed operational requirements for availability and maintainability. The weapon was to be available for operations 90 percent of the time. In the test, its operational availability was not better than 64 percent. This did not include downtime while waiting for logistics support and for administrative purposes. The agency estimated that had these been considered, the gun's availability would have been only 33 percent. The Sergeant York's mean time to repair was required to be 0.5 hours or less at the organizational level and 1 hour or less at the direct support level. As tested, the mean time to repair the system at all levels was 2.01 hours.

The third Army evaluation, also based on the trial results, was completed in the Office of the Secretary of the Army on August 22, 1985. This evaluation represented the Army's official position. It found the Sergeant York's performance to be significantly better than the Vulcan's, although some system shortcomings still required correcting. It did not recognize the limitations of the criteria as had the previous evaluations.

In commenting on a draft of this report, DOD stated that the Army's evaluation of the test results had not proceeded through three distinct levels but had been a total product based on established procedures. It stated that the Army's Combat Developments Experimentation Center report was not meant to be a final report because a detailed analysis of all the trials was not yet available. DOD further stated that while it might appear that the Army's final assessment, conducted by an independent Army assessment team, was more favorable than the initial evaluation, additional and more valid test results and technical evaluations were available at the time of the final assessment.

Office of the Secretary of Defense
Found That Operational
Requirements Had Not Been Met

Evaluators of the newly created Office of Operational Test and Evaluation in the Office of the Secretary of Defense, reviewing the same data as the Army had evaluated, found that although the Sergeant York represented an improvement over the current Vulcan air defense gun, it did not adequately protect friendly forces during simulated combat. They also found that the Sergeant York was not operationally suitable because of its low availability stemming from its being frequently down for maintenance.

According to Office of the Secretary of Defense officials, the Army's operational test results demonstrated that the Sergeant York could not

effectively meet the Soviet helicopter threat. Helicopters, when they stood off beyond the gun's range, effectively delivered firepower against the friendly forces. Overall, the gun brought down an unacceptably small number of helicopters and the forces it was protecting suffered large losses.

Objectives, Scope, and Methodology

Our objectives were to (1) examine the acquisition strategy established for the Sergeant York and determine to what extent it had been helpful in enabling the Army to achieve its acquisition objectives, (2) determine the degree of protection that the Sergeant York contract's warranty provisions provided the government, particularly with respect to containing program cost, and (3) determine to what extent the Sergeant York was meeting its performance requirements.

To accomplish these objectives we examined pertinent documentation from the Department of Defense, the Army, and the contractor. The key documentation examined included

- Army testimony on the acquisition strategy and program progress;
- the Army's required operational capability;
- the phase II contract for system maturity and initial production, with particular attention to its development specification and the warranty provisions; and
- Army and contractor test reports, as well as Army and Department of Defense evaluations of those tests.

We performed our work primarily at the Army's Sergeant York project office, Dover, New Jersey. We also held discussions with representatives of the U.S. Army Operational Test and Evaluation Agency, Falls Church, Virginia; the U.S. Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Maryland; the U.S. Army Air Defense Center, Fort Bliss, Texas; the U.S. Army Combat Developments Experimentation Center, Fort Ord, California; the U.S. Army Office of Missile Electronic Warfare and the U.S. Army Training and Doctrine Command Systems Analysis Activity, White Sands Missile Range, New Mexico; the Office of the Secretary of Defense, the Pentagon; and Ford Aerospace and Communications Corporation, Newport Beach, California. We also observed Sergeant York testing at the Army's North McGregor Range, Fort Bliss, Texas; Fort Hunter Liggett, California; and Red Rio Area, White Sands Missile Range, New Mexico.

Appendix I
Assessment of the Accelerated Strategy Used
to Acquire the Sergeant York

We began our review in June 1984 and completed it in August 1985. Our review was performed in accordance with generally accepted government auditing standards.

Comments From the Department of Defense



RESEARCH AND
ENGINEERING

THE UNDER SECRETARY OF DEFENSE

WASHINGTON D.C. 20301

3 MAR 1986

Mr. Frank C. Conahan
Director
National Security and
International Affairs Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "SERGEANT YORK: Concerns About the Army's Accelerated Acquisition Strategy," dated January 8, 1986 (GAO Code 393004/OSD Case 6915).

The DoD generally concurs with the draft report. Detailed comments on the report findings and recommendations are provided in the enclosure. The Department appreciates the opportunity to comment on the draft.

Sincerely,

A handwritten signature in dark ink, appearing to read "Donald A. Hicks".

Donald A. Hicks

Enclosure

GAO DRAFT REPORT - DATED JANUARY 8, 1986
(GAO CODE 393004) - OSD CASE 6915

"SERGEANT YORK: CONCERNS ABOUT THE ARMY'S ACCELERATED
ACQUISITION STRATEGY"

DEPARTMENT OF DEFENSE COMMENTS

* * * * *

FINDINGS

- **FINDING A: Features Of The Acquisition Strategy.** The GAO noted that the SERGEANT YORK acquisition strategy was unique in that it attempted to accelerate fielding, and at substantial cost savings to the Government. The GAO also noted that the features of the acquisition strategy included:
 - parallel, competitive development;
 - a "skunk works" approach to contracting in which contractors were given free rein to design the system to meet the Army's requirements;
 - the "hands-off" approach in that the Government's management role was minimal;
 - combining development and operational testing prior to production; and
 - combining the systems' follow-on development with initial production.

The GAO found that these factors were intended to significantly shorten the development phases preceding initial production. The GAO also found that Army recognized that this approach had technical and cost risks. The GAO additionally found that to minimize these risks, the Army specified that contractors use already proven subsystems in weapon design and negotiated (1) a fixed-price development contract with fixed-price production options and (2) warranty provisions which protected the Government against cost increases resulting from corrections of design and other deficiencies. The GAO noted that the Secretary's August 27, 1985 decision to cancel the \$4.04 billion procurement of 614 gun systems was based on the weapon's

ENCLOSURE

inability to effectively protect friendly forces, and because he did not believe the marginal improvement over existing weapon systems was worth the large investment it would take to complete the program. The GAO concluded that the Army should continue its efforts to reduce the time it takes to develop and field new weapons, but there are lessons to be learned from the events that followed the application of the accelerated strategy. (p. 1, p. 3, pp. 9-11, and pp. 1-3, p. 7, Appendix I, GAO Draft Report)

DoD POSITION: Concur.

- **FINDING B: Competitive Prototyping.** The GAO noted that the first phase of the acquisition strategy was competition between two contractors, with each delivering complete prototypes to the Army for testing. The GAO found that the advantages of this approach were: (1) having more than one candidate for the mission, (2) having actual hardware on which to base a comparison, and (3) stimulating individual contractor creativity in devising a weapon to fulfill the mission. The GAO found that the Army decided to select a contractor for the phase II full scale development and initial production contract after the competitive development and operational tests were completed and evaluated. The GAO also found that, at the time, both prototypes displayed numerous shortcomings and still required considerable development. The GAO concluded that, as a result, (1) some of the advantage of the competition may have been lost, and (2) it may have been prudent to wait for the further development of both prototypes before making a selection. (p. 4, and pp. 3-4, Appendix I, GAO Draft Report)

DoD POSITION: Concur.

- **FINDING C: Minimum Government Involvement And Limited Concurrent Testing Provided Insufficient Information For Decisionmakers.** The GAO found that the "hands off" strategy embodied (1) having thinly staffed Government and contractor project offices shielded from interference by other concerned Government officials, (2) reducing the reporting requirements, (3) limiting access to contractors and contractor information, and (4) giving the contractors flexibility to design and develop a weapon that would satisfy Army requirements. The GAO found that the Army chose to (1) perform developmental testing concurrently with production and (2) conduct less testing before the production decision than is usually done under a more

Now on pp 1-2, 6-7, and
14-18

Now on pp 3 and 15-16

conventional acquisition strategy. The GAO noted that developmental tests, deferred until after production began, included operations in a cold climate, durability in stressful battlefield conditions, system transportability, and electromagnetic tests. The GAO found that, although operational tests were scheduled before production, they were constrained by the limited realism of the test environment. GAO concluded that the "hands-off" management strategy by the Army during phase I and the limited testing did not provide essential performance information, making it difficult to justify funding requests for the program and, as a result, contributed to program delays. The GAO further concluded that the minimum Government involvement, particularly during the competition, precluded in-depth knowledge and release of technical information, inhibiting essential data on system performance from reaching those who were to make funding and programming decisions. The GAO additionally concluded that, because the strategy limited the opportunities for testing, it did not give decisionmakers as much information at given points in time as they normally receive under more conventional strategies. The GAO finally concluded that confining surveillance over the system's development early in the program to just a few Army officials provided little opportunity to hold the program up to wider and more critical scrutiny in the Army's higher echelons, the OSD and the Congress. (p. 2, pp. 4-8, p. 10, and pp. 16-21, Appendix I, GAO Draft Report)

DoD POSITION: Concur.

- **FINDING D: Protection Offered By Warranty Provisions.** The GAO found that the contract to acquire the SERGEANT YORK provided protection from cost increases caused by defects in the design, component integration, materials or workmanship. This protection, according to the GAO, went well beyond that generally obtained for other weapon systems where the contractor's liability does not cover design defects. Specifically, the GAO noted, the warranty provisions made the contractor responsible for correcting the defects without increases to the contract's target cost, target ceiling or ceiling price, and without extensions of delivery time. The GAO also noted that under the warranty, the performance of the system was to be measured against detailed requirements in the contract's development specifications. The GAO found that the contractor's warranty did not extend to performance of the system in an operational environment; instead, these requirements (mission performance and survivability) were to be demonstrated under test conditions which represented a

Now on pp 15, 7 and
25-27

realistic battlefield environment. The GAO also found that the contractor would not have been obligated under the warranty to correct deficiencies disclosed in this test. The GAO concluded, however, that it seems probable the benefits derived from having a warranty requiring a system to perform to specification in a nonoperational environment will, to a certain extent, carry over to its performance in an operational environment. (pp. 8-9, p. 11, and pp. 7-8, Appendix I, GAO Draft Report)

DoD POSITION: Concur.

- **FINDING E: Cost Control Was Maintained.** The GAO found that the fixed-price contract was viewed as complementing the "hands-off" and tradeable requirements features by eliciting the contractors' best efforts for a given price, and that the contract included fixed price production options made by each contractor during the competition. The GAO found that, until the program's termination in August 1985, costs to the Government had remained relatively stable. The GAO concluded that this was a significant achievement, considering the pattern of cost growth exhibited by many weapons during their development and early production. The GAO also found that while the competitive development of integrated prototypes and use of proven components contributed to this favorable cost experience, the fact that significant technical problems still occurred suggests the use of the fixed-price development contract and production contract options were effective cost control features of the acquisition strategy. The GAO found, however, the fixed-price options did have a drawback in that they put pressure on decisionmakers to proceed with production on schedule to take advantage of favorable pricing, despite the system's technical difficulties and unknowns. The GAO concluded that a major challenge to the Army's ability to maintain the program's cost control would have come with the negotiation of the first full production contract scheduled to be awarded in January 1986. According to GAO, that contract was to be negotiated with the benefit of actual production experience, but without the price protection the fixed price options had provided. The GAO further concluded that cancellation of the program leaves unanswered the question of whether cost control would have continued. (pp. 5-6, and pp. 9-11, Appendix I, GAO Draft Report)

DoD POSITION: Concur.

- **FINDING F: Accelerated Deployment Not Achieved.** The GAO found that the acquisition strategy did not achieve early

Now on pp 6-7 and 17-19

Now on pp 4 and 19 20

deployment of the SERGEANT YORK. In addition, the GAO found that the gains in time the Army anticipated from combining development testing and initial production were never realized. The GAO noted, for example, that the system would not have reached operational capability until 10 years after program initiation, compared with the 6- $\frac{1}{2}$ years originally planned. The GAO further found that the major causes of this delay appeared to be (1) deletion of fiscal year 1981 production due to funding cuts, which delayed the first year's production by about 1- $\frac{1}{2}$ years and (2) production start-up problems, which delayed deliveries. The GAO found, however, that the 10 year interval is still somewhat less than was experienced by seven other weapon systems the GAO used for comparison purposes. These other systems, according to the GAO, acquired under more conventional strategies, averaged 12 years from program initiation to operational capability. In another comparison, the GAO found that the Multiple Launch Rocket System, using an acquisition strategy similar to the SERGEANT YORK's, was fielded is just over six years, or only four months later than planned. The GAO concluded that several factors appear to explain why, under a strategy similar to the SERGEANT YORK, a system was fielded essentially within six years. First, the GAO noted, that the rocket system is made up of previously applied technology and is relatively uncomplicated. Second, time was set aside for final operational testing prior to the full-scale production decision, whereas, the SERGEANT YORK strategy did not provide for such testing until after full-scale production was approved. Third, although the rocket system exhibited reliability and accuracy problems even when full-scale production began, the program was not delayed to correct the problems, as was done with the SERGEANT YORK. The GAO concluded that the desired acceleration in fielding the SERGEANT YORK was not achieved due to both weaknesses in the acquisition strategy and the technical difficulties of the weapon itself, although it is difficult to sort out the relative contribution of each. The GAO also concluded, however, that the technical problems of the system were not due to the acquisition strategy, and that technical difficulties can be encountered in developing any complex system, irrespective of the acquisition strategy used. The GAO finally concluded that while the SERGEANT YORK acquisition strategy contained some positive elements, on the whole, it was detrimental to the program. (pp. 6-7, p. 9, and pp. 12-16, Appendix I, GAO Draft Report)

DoD POSITION: Concur. A third cause of the delay was the requirement to do additional operational testing before exercising the FY 1984 (third) production option of the Phase II contract.

Now on pp 4-6 and 21 25

- **FINDING G: Performance In Testing Was Unsatisfactory And Important Specifications Not Met.** The GAO found that the system test units were less technically mature than anticipated during the program, giving rise to testing delays and the need for additional testing. The GAO concluded that the system's major subsystems, as well as their application to a weapon for which they were not originally designed, represented a greater technical undertaking than anticipated. The GAO also found that the contractor encountered problems in making the transition from prototypes to production units, including test failures, design changes, rework, and assembly difficulties. The GAO found that, as a result, the OSD directed the Army not to exercise the third production option until solid test results were available, including realistic operational testing. The GAO noted that additional limited tests were conducted, but the results were inconclusive because of limited realism of the test and lack of statistically significant numbers. According to the GAO, further tests would have been held in 1987, had the program continued. The GAO found that the most definitive tests were completed in mid-1985, and these initial production and follow-on operational tests were the first attempts to assess the system in a realistic environment. The GAO noted that the analysis performed by the DoD Director, Operational Test and Evaluation, while acknowledging improvement over the current Vulcan air defense gun, concluded that the SERGEANT YORK was ineffective in protecting friendly forces and unsuitable for combat operations because of its low operational availability. The Army, however, while noting that some shortcomings remained, ultimately concluded that the results of initial production and operational tests were favorable, including the determining test factor--friendly force's survival. The GAO reported that the Army conducted three levels of review of the test results and concluded that, as the evaluations progressed through the various levels, the results became more favorable. The GAO noted, for example, that the third Army evaluation, based on the trial results, was completed in the office of the Secretary of the Army on August 22, 1985. According to the GAO, it was advised that this represented the Army's official position and that the Army found the SERGEANT YORK's performance to be very favorable. The GAO concluded that the limited Army surveillance, coupled with confidence in the use of proven components fueled optimism about the system's eventual

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performance and enabled the initial production decision to be made on the basis of limited testing, although subsequent test results showed these views to be overly optimistic. The GAO also concluded that the wisdom of the Secretary's decision to cancel the program was borne out by the tests results. (pp. 7-8, p. 10, and pp. 16-24, Appendix I, GAO Draft Report)

DoD POSITION: Partially Concur. The DoD concurs with the GAO conclusion that the Secretary of Defense's decision to terminate the SERGEANT YORK was borne out by the test results. The GAO explanation of how the test was evaluated by the Army needs clarification, however. The Army's evaluation of SERGEANT YORK did not state that the results were favorable. The Army stated that SERGEANT YORK was significantly better than VULCAN in terms of blue force survival, but proved to be ineffective against a current threat related to hovering helicopters standing off at ranges greater than those for which the system was designed. Further, the Army's evaluation of the test results did not proceed through three distinct levels, but was evaluated in total through established Army review procedures. Due to the enormous amount of data collected during the operational test, the Army's independent operational tester, Operational Test and Evaluation Agency (OTEA), formed a Data Analysis Group to collect, reduce, analyze and evaluate the test results. The Army's Combat Development Experimentation Center (CDEC) report was an early quick look assessment of the results. It was not meant to be a final report because a detailed analysis of all the trials was not yet available. After the completion of the operational test in June 1985, the Army formed an independent assessment team that was tasked to look at the operational test results/evaluation and make its own assessment of the SERGEANT YORK in order for it to accomplish its air defense mission. While it may appear that the final assessment was more favorable than the initial evaluation, it must be kept in mind that additional and more valid test results and technical evaluations were available by the time of the Army briefings to the Secretary of the Army and Secretary of Defense on August 22, 1985.

RECOMMENDATIONS

- **RECOMMENDATION 1:** The GAO recommended that when the Army consider such strategies for future programs, the Secretary of Defense require the Army to make an initial detailed assessment of the technical risks involved in individual

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subsystems, as well as in the integration of those subsystems into one system, with an explicit focus on whether the technology being attempted is compatible with an accelerated acquisition strategy. (According to the GAO, built into the strategy should be provisions for adjusting schedules and other program facets, if technical difficulties occur.) (p. 11, GAO Draft Report)

DoD POSITION: Concur. No additional guidance is required, however, because the essence of the GAO recommendation was in effect at the time decisions were made on the SERGEANT YORK program. In the case of the SERGEANT YORK, a conscious decision was made by the DoD, with the knowledge of the Congress, to use a unique acquisition strategy with recognized risks. In retrospect, specific lessons have been learned, particularly with respect to the "hands off" aspects of the strategy. These lessons, coupled with the DoD Inspector General's Audit, "Effectiveness of the Defense Systems Acquisition Review Council Process," and the procedures in applicable DoD directives, should preclude a similar situation from occurring in the future.

The DoD Instruction 5000.2, "Major Systems Acquisition Procedures," already requires, as early as Milestone O, that the maturity of the technology planned for the selected system be discussed with an assessment of risk in the Justification For Major System New Start (JMSNS). Also in the System Concept Paper (SCP) and Decision Coordinating Paper (DCP), for Milestones I and II/III, respectively, the technological risks, as well as the general acquisition strategy for the entire program and the detailed acquisition strategy for proceeding to the next milestone, are required to be discussed. Further, the DoD Directive 5000.1, "Major Systems Acquisition," requires that the acquisition strategy tailor the prescribed steps in the major system acquisition decision-making process to the strategy. DoD Directive 4245.7, "Transition from Development to Production," requires a formal program of risk assessment and authorizes a recently published manual, which provides guidance on ways to reduce risk to acceptable levels.

- **RECOMMENDATION 2:** The GAO recommended that when the Army considers such strategies for future programs, the Secretary of Defense require the Army to assess the weapon's technological progress periodically to see if it is still compatible with the planned acceleration. (In the view of the GAO, if technical progress is no longer keeping pace with the acceleration, the strategy should be adjusted to bring it in line with the technology.) (p. 12, GAO Draft Report)

DoD POSITION: Concur. Again, no additional guidance is required because the essence of the GAO recommendation was in effect at the time decisions were made on the SERGEANT YORK program. In the case of the SERGEANT YORK, a conscious decision was made by the DoD, with the knowledge of the Congress, to enter a unique acquisition strategy with recognized risks. In retrospect, specific lessons have been learned, particularly with respect to the "hands off" aspect of the strategy. These lessons, coupled with the DoD Inspector General's Audit, "Effectiveness of the Defense System Acquisition Review Council Process," and the procedures in applicable DoD directives, should preclude a similar situation from occurring in the future. The DoD Directive 5000.1, for example, specifies that Milestone II may be delayed until additional development has been accomplished to provide better definition of the system, thereby reducing further risk or uncertainty. Furthermore, DoD Instruction 5000.s and the DoD Directive 5000.1 establish the means to conduct program reviews at anytime in the acquisition process. Approval of an accelerated acquisition strategy does not relieve the program's management of the responsibility and the requirement to subject the decisions specified in OMB Circular A-109, "Major Systems Acquisitions."

- **RECOMMENDATION 3:** The GAO recommended that when the Army considers such strategies for future programs, the Secretary of Defense require the Army to ensure the strategy gives decisionmakers (1) timely evaluations of the weapon's performance based on adequate and realistic operational testing before a production decision is made, and (2) sufficient information on program progress. (p. 12, GAO Draft Report)

DoD POSITION: Concur. The DoD Directive 5000.1 specifies that throughout the acquisition process, emphasis shall be placed upon verifying actual performance through test and evaluation. The procedures of the DoD Directive 5000.3, "Test and Evaluation," will be integral to all systems acquisition planning and decision making. Additional emphasis is being placed upon realistic, timely operational testing and adherence to documentation required by applicable acquisition directives. The revised DoD Directive 5000.3, incorporating this emphasis in accordance with current legislation, is projected to be published by March 1986. Public Law 98-94 become effective on September 24 1983 (subsequent to the decision for SERGEANT YORK to enter full production), and stipulates that a full-

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production decision not be made until the Director, Operational Test and Evaluation, has submitted a report to the Secretary of Defense and the Congress stating that an adequate test of the system was conducted and the results confirm it is effective and combat suitable. Such tests and reports became available on the SERGEANT YORK after the system was in production and formed part of the determination to cancel the program. The Federal Acquisition Regulations give guidance in selecting the type of contract as a function of risk. The choice of contract generally proceeds from cost reimbursement to fixed-price, as development translates to production. The DoD Directive 5000.1 and DoD Instruction 5000.2 establish the procedures to obtain sufficient information on program progress for decisionmakers both through scheduled reviews and continuing staff interaction to "Maintain current visibility over matters such as cost, supportability, T&E, industrial base responsiveness, and production readiness throughout the acquisition process."

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